

TAKING AN ALTERNATIVE ROUTE

**FACTS ABOUT**

**CNG & LPG  
CONVERSION**

ALTERNATIVE FUEL INFORMATION  
U. S. DEPARTMENT OF ENERGY

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## Introduction

In 1994, about 55,000 vehicles in the United States ran on compressed natural gas (CNG), and at least 231,650 ran on propane.<sup>1</sup>

Recent federal energy and environmental legislation affects the fuel and vehicle choices of some U.S. fleet operators. The Energy Policy Act of 1992 (EPACT) requires certain federal and state fleet operators and alternative-fuel providers to acquire alternative-fuel<sup>2</sup> vehicles (AFVs). Some private, municipal, and other fleet operators may also be required to obtain AFVs in the future. The Clean Air Act (CAA) introduced the Clean Fuel Fleet program, which requires that some fleet operators in cities with the greatest air pollution acquire vehicles that meet special Clean Fuel Vehicle emission standards.<sup>3</sup> State and local requirements also affect the fuel and vehicle choices of fleet operators. The requirements vary from area to area and depend on the specific makeup and location of a fleet.

The U.S. Department of Energy (DOE) encourages automakers to produce as many alternative-fuel models as possible. Original equipment manufacturer (OEM)

AFVs are designed specifically to use an alternative fuel, such as CNG or propane. The engine, emissions, and performance of the vehicle are optimized for that fuel. Such a vehicle features a unique engine, catalyst, and single- or multi-point fuel injection system that meters fuel more precisely. The on-board computer is designed specifically for the fuel; the suspension system and shocks may be designed to withstand the added weight of CNG or propane tanks; and the fuel system parts are designed and installed specifically for that type of vehicle. The engine is upgraded to withstand the increased durability requirements of gaseous fuels.

Because the supply of OEM vehicles is limited, however, some fleet operators may choose to convert vehicles as a way to meet vehicle acquisition requirements. Conversions serve as a transition to the time when more AFVs become available for public sale. Originally designed to operate on gasoline or diesel, a converted vehicle has been altered to run on an alternative fuel. Compressed natural gas and propane<sup>4</sup> are the two most common types of fuel for such vehicles.

## Types of Conversions

In an aftermarket conversion, a conversion kit is added to a vehicle designed for gasoline so that it can operate on an alternative fuel. Each manufacturer's conversion kit, also called an aftermarket fuel delivery system, is slightly different, but the basic design and operation are similar. Conversion equipment generally consists of fuel tanks, fuel lines, a pressure regulator, and a mixer or carburetor to mix the fuel with incoming air. Most conversion kits also include an electronic system to control the fuel/air mixture for optimal emissions performance. All original emissions control equipment must remain on the vehicle.

Some converted vehicles can run on either alternative fuel or conventional fuel. Such vehicles have two separate fuel tanks. Bi-fuel systems use only one fuel at a time; they are particularly advantageous when alternative-fuel refueling stations are not always readily available. A switching system is added as part of the conversion so that the driver can switch from one fuel to the other. Dual-fuel systems, on the other hand, run on a combination of an alternative fuel and diesel; they inject both fuels into the combustion chamber at the same time. Dual-fuel systems are used mostly in heavy-duty diesel engines, while bi-fuel systems are usually used in passenger cars or light- and medium-duty trucks.<sup>5</sup>

Dedicated conversion systems run on only one fuel. These systems generally provide reduced emissions and better performance if they are tuned to optimize operations on only one fuel, and they have no evaporative emissions because they use no gasoline.

Closed-loop systems use a feedback system to monitor and adjust engine performance. An oxygen sensor in the exhaust system monitors the fuel/air

mixture to the engine and compensates for changes, thereby optimizing emissions performance.

Open-loop systems, in which carburetors are throttle-regulated, do not provide optimum emissions performance because they do not compensate for changes in the fuel/air mixture. Such systems are generally used on older model vehicles that do not have computerized fuel control systems.

## CNG Systems

In CNG vehicles, the fuel is stored at pressures of 2,400-3,600 pounds per square inch (psi) in one or more cylinders located under the body or in the trunk of the vehicle. The filling valve is placed near the tank or in the front grille. When the CNG leaves the cylinder tank, it travels through high-pressure fuel lines into one or more pressure regulators, where it is reduced to low atmospheric pressure. Unlike gasoline, which must be vaporized before ignition, CNG is already gaseous when it enters the combustion chamber. When the intake valve opens, the gas enters the combustion chamber, where it is ignited to power the vehicle.

## Propane Systems

In propane vehicles, the fuel is stored as a liquid, usually in one tank, at low to moderate pressure that depends on ambient air temperatures. For example, at 70 degrees Fahrenheit, the pressure inside a propane storage vessel is 127 psi; at 100 degrees Fahrenheit, the pressure is 196 psi. The propane travels from the tank to a vaporizer/pressure regulator, also called a converter, where it is transformed into vapor. The vapor travels to an air/fuel mixing device that feeds the engine.

## Vehicle Performance and Maintenance

Converted vehicles drive in much the same way as gasoline vehicles. The most significant difference a driver may notice is a slight power loss. For example, using CNG in an engine not originally designed for it may result in a 10-15% power loss; using propane may reduce power by up to 7%.

This power loss is primarily related to the displacement of intake air by the fuel vapor. (In contrast, gasoline is metered as a liquid, so it displaces very little intake air.) Excessive power loss, however, may indicate improper installation or tuning of the conversion system. As in gasoline vehicles, power and performance can be optimized by adjusting the air/fuel mixture, ignition timing, and compression ratio.

Converted vehicles should be tuned up according to the kit manufacturer's instructions and schedule. Dealers will honor warranties only if AFVs abide by the same tune-up intervals as those recommended for gasoline or diesel vehicles. For more information about when to tune a CNG or propane vehicle, consult the owner's manual and warranty.

## Refueling

Far fewer refueling stations exist for CNG and propane than for gasoline or diesel. Although the infrastructure is expanding, CNG and propane vehicles often must return to their home bases for refueling, and CNG vehicle range limitations can require more frequent refueling.

The CNG cylinders that typically power light-duty vehicles have a range of 80-100 miles, about 70-80% less than that of a gasoline vehicle. In most converted bi-fuel CNG vehicles, the original gasoline tank is retained to provide additional range. If

more cylinders are added to improve range, however, the increased weight and reduced trunk space will decrease the vehicle's efficiency and capacity.

CNG vehicles have two basic types of refueling systems: slow-fill and fast-fill:

- The slow-fill method uses a compressor that directly compresses natural gas from a pipeline and dispenses it to the on-board storage tank. Because it can take up to 14 hours to fill the tank, this method is more suitable for fleets. Smaller slow-fill compressors are also available for refueling one vehicle at a time at a home garage. Check with local building and fire authorities before installing such a system.
- The fast-fill method involves filling the vehicle's on-board storage tank from high-pressure ground storage tanks that are filled from a natural gas pipeline by a compressor. The fast-fill method takes the same time as conventional gasoline pumping (2-5 minutes). This method is suitable for both public and fleet refueling stations.

The range of propane vehicles is 20-25% less than that of gasoline vehicles with comparable tank size. This difference is compensated by propane tanks that are slightly larger than conventional gasoline tanks. Refueling a propane vehicle involves filling the on-board storage cylinder from a dispenser connected to a bulk storage tank. This method takes the same amount of time as refueling a gasoline or diesel vehicle. Just as propane is stored in the engine fuel tank as a liquid, it is stored and handled as a liquid at the fuel dispenser. The propane is pumped from the dispenser storage tank into the vehicle tank.

CNG and propane leakage can be hazardous in closed garages. Vehicle storage, maintenance, and refueling facilities must comply with nationally recognized standards and local building and fire codes. As in the case of gasoline, CNG and propane refueling sites must follow stringent safety regulations (see Safety Standards).

## **Conversion and Fuel Costs**

CNG conversion kits for light- and medium-duty vehicles can cost \$3,800-\$5,000; propane kits cost about \$2,500-\$3,000. Closed-loop conversions are more expensive than open-loop systems. For CNG systems, the most expensive part of the conversion kit is the tank. The cost of converting varies according to the number and size of the tanks.

To help offset the cost, the federal government has set up financial incentives for companies that convert their fleets and individuals who convert their personal vehicles. Title XIX of EPACT allows a deduction from adjusted gross income of up to \$2,000 for a passenger vehicle and up to \$50,000 for a heavy-duty truck. The deduction also applies to the purchase of OEM vehicles. The real dollar value of these deductions depends on the depreciation method and income tax rate. State and local tax incentives may also be available.

The investment payback of a conversion depends on how many miles the vehicle travels in a year, its original fuel economy, the initial cost of the conversion, and the vehicle resale value. The conversion equipment adds weight to the vehicle and, therefore, slightly increases fuel consumption. If the alternative fuel is less expensive than gasoline, however, the cost of the conversion may be paid back over time.

Because some states exempt alternative fuels from all or part of the motor fuel tax, the prices of natural gas and propane vary from region to region. Fuel price may also vary between fleet use and individual vehicle use because companies may have contract fuel rates with a natural gas utility company or propane fuel supplier. Therefore, it is difficult to compare fuel costs on a national basis or to predict the future price of alternative fuels.

## **Warranty Issues**

Although CNG and propane conversions do not usually cancel a vehicle manufacturer's warranty, failures caused by the conversion system are not generally covered. If the conversion kit or its parts fail or cause another part of the vehicle to malfunction, the cost of the repair is often covered by the kit manufacturer's or installer's warranty.

Certain states require aftermarket kits to be warranted. For example, the California Air Resources Board (CARB) requires manufacturers to warrant their alternative-fuel retrofit systems to workmanship and materials specifications similar to those for a new car warranty. The CARB warranty must be effective for 3 years or 50,000 miles, whichever comes first, and it must cover the full repair or replacement costs. Such costs cover diagnosis, labor, and parts, including any original part of the vehicle that is damaged because of the retrofit system. In addition, some costlier components must be warranted for 7 years or 70,000 miles, whichever comes first. Installers must also warrant the alternative-fuel retrofit system to be free from any malfunction or damage due to improper installation.

Some automakers have made arrangements with outside conversion companies

to install alternative-fuel systems in vehicles that are “prepped” by the OEM. In these cases, the automaker designates the kit manufacturer as a qualified vehicle modifier (QVM). A significant benefit of this type of conversion is that a single comprehensive warranty is available through the vehicle dealer.

As AFVs become more available, more states may follow California’s lead in requiring kit manufacturers and installers to provide warranties, and automakers will continue to explore the idea of QVM agreements. Before converting a vehicle, however, find out what kind of warranty the kit manufacturer supplies. Also, read the vehicle’s warranty and contact the vehicle manufacturer to find out whether converting to an alternative fuel would affect that warranty.

## **Tampering and Emissions Regulations**

Section 203 of the CAA outlines federal tampering provisions. Emission control devices, such as catalytic converters, must remain on the vehicle. Removing them is a violation of the tampering laws and is subject to fines of up to \$25,000 for manufacturers or dealers and up to \$2,500 for other persons.

The U.S. Environmental Protection Agency’s (EPA’s) position on emissions is outlined in Mobile Source Enforcement Memorandum No. 1A (Memo 1A), which states that vehicle modifications cannot increase vehicle emissions. The final rule on “Standards for Emissions from Natural Gas-Fueled Vehicles and Motor Vehicle Engines, and Certification Procedures for Aftermarket Conversion Systems” (Federal Register, September 1, 1994) establishes emissions standards and test procedures for CNG and LPG vehicles.

The EPA does not mandate certification, but a Certificate of Conformity for a vehicle type protects the converter against tampering liability. To be certified, conversion kits must achieve lower emissions than the original vehicle. The certification process involves emission testing on equipment that can distinguish differences in emissions at very low levels. The converter must accept liability for in-use emission performance of all vehicles converted under the certificate. In addition, vehicle types certified to certain emission standards are eligible for the Clean Fuel Fleet and other Clean Fuel Vehicle programs. (See the Appendix.)

Both EPA and DOE recommend using conversion kits that have been tested at a laboratory EPA-certified by the Federal Test Procedures in 40 CFR (Code of Federal Regulations) Part 86. The test results should prove that the use of these kits does not adversely affect emissions from a properly maintained motor vehicle.

Some states, such as California and Colorado, also have emissions standards and tampering laws that affect conversions. Before converting a vehicle, check with the state air control agency to find out what restrictions apply, and call the state environmental agency to find out whether conversion kits or aftermarket parts are certified in your state.

Every manufacturer must have its conversion kit tested. Before choosing a conversion kit, ask the kit manufacturer for results of the emissions tests to make sure the kit meets federal, state, and local emissions standards.

## **Safety Regulations**

### ***Government Safety Standards***

The National Highway Traffic Safety Administration (NHTSA), an agency of the U.S. Department of Transportation (DOT), is authorized to ensure the safe performance of AFVs, including conversions. The NHTSA has issued safety standards related to alternative fuel:

- Fuel Integrity Systems (Standard No. 303) became effective on September 1, 1995. This safety standard applies to OEM natural gas and propane vehicles. It requires AFVs to meet a 30-mph barrier crash test (without exceeding specified leakage limits) with limited damage.
- Compressed Natural Gas Fuel Containers (Standard No. 304) became effective on March 27, 1995. This safety standard outlines performance and labeling requirements for CNG containers. To prevent fires caused by CNG leakage, the containers must undergo a pressure cycling test to evaluate durability, a burst test to evaluate initial strength, and a bonfire test to evaluate pressure relief characteristics.

### ***State Safety Standards***

Because of the hazards of high-pressure fuel systems, some states place restrictions on CNG and propane vehicles driving over bridges and through tunnels and parking in underground lots. Although no uniform restrictions exist, many regulations are geared toward transporting gaseous fuel as cargo rather than as an engine fuel. To find out what restrictions apply in your area, contact your local fire protection agency.

### ***Industry Safety Standards***

Although no government safety standards exist for CNG and propane conversion kits, voluntary industry standards are in place. Companies are not required to follow industry standards, but they help reduce uncertainty and ensure reliability and safety.

The American National Standards Institute (ANSI) is a private nonprofit organization that coordinates voluntary consensus standards systems and approves American National Standards. ANSI-accredited developers ensure that a single set of nonconflicting standards is formulated, and all interests concerned have the opportunity to participate in the development process.

ANSI has accredited standards developed by the Natural Gas Vehicle Coalition:

- Compressed Natural Gas Vehicle Fueling Connection Devices (NGV1) establishes standards for construction, performance testing, and safe operation of NGV fueling nozzles and receptacles.
- Basic Requirements for Compressed Natural Gas Vehicle Fuel Containers (NGV2) contains standards for construction, performance testing, and safe operation of onboard CNG storage containers for vehicles.
- Fuel System Components for Natural Gas Powered Vehicles (NGV3) sets standards for construction, operation, and testing of components for NGV fuel systems.

Another standard, CNG Fueling Station Components (NGV4), is currently in draft form and awaiting accreditation.



The National Fire Protection Association (NFPA) has also issued American National Standards related to AFVs:

- Compressed Natural Gas Vehicular Fuels Systems (NFPA 52) addresses proper installation of aftermarket conversion kits and emphasizes general CNG and equipment qualifications; engine fuel systems; CNG compression, storage, and dispensing systems; and residential fueling facilities. Some states have adopted NFPA 52 as law.
- Storage and Handling of Liquefied Petroleum Gases (NFPA 58) covers many propane applications outside engine fuel systems, but Chapter 8 (Engine Fuel Systems) is of particular importance with regard to conversions. It includes provisions for propane containers, container appurtenances, carburetion equipment, piping, hose, fittings, and their installation. It also contains provisions for garaging of vehicles. Most states have adopted NFPA 58 as the basis of safety regulations for propane.

### ***Technician Certification***

The safety of a converted vehicle depends on the quality of its workmanship. The National Institute for Automotive Service Excellence (ASE) developed a written certification test to measure the knowledge and skills of technicians who install, diagnose, and repair converted CNG vehicles.

Some states, such as Texas and Oklahoma, also require training certification for technicians who install, modify, repair, or renovate equipment used in the conversion of any alternative-fuel engine. Check with the state air quality or auto repair agency regarding certification requirements for technicians in your area.

The DOE is also developing national standards for technician certification and conversion training programs.

### ***CNG and Propane Cylinder Codes***

Both CNG and propane cylinders are manufactured according to rigorous safety standards.

CNG cylinders are tested according to ANSI codes. The tests can be conducted at any ANSI-certified laboratory. They may include repeatedly overpressurizing and depressurizing the tank thousands of times; placing the tank in a fire to be sure the pressure relief device works and the tank does not burst; and dropping the tank from a height of 6 feet. CNG cylinders must exceed a safety factor of at least 2.25-3.5 times the pressure of the tank.

CNG cylinders manufactured to DOT standards may need to be recertified periodically: every 5 years for steel cylinders and every 3 years for steel composite and aluminum composite cylinders. CNG conversions may also use cylinders manufactured according to NGV2 standards; these have a 15-year useful life. Check with your cylinder manufacturer for specific recertification requirements.

Because propane is not stored at such high pressures, the testing for propane cylinders is not as rigorous as that for CNG cylinders. Every propane cylinder must be exposed to twice its service pressure, and one out of every 500 is exposed to four times its pressure, or about 960 psi.

Two types of containers are authorized for propane: DOT cylinders and American Society of Mechanical Engineers (ASME) tanks:

- DOT cylinders are manufactured under the provisions of DOT Hazardous Materials Regulations. They must be requalified for

continued use 12 years from the date of manufacture. If the DOT-authorized visual inspection procedure is used, the cylinders must be requalified every 5 years thereafter. They must be checked for physical wear or damage every time they are refilled, and the paint must be kept in good condition. DOT engine fuel cylinders are usually removed from the vehicle and refilled elsewhere, though they may be refilled in place if they are properly installed and equipped for that purpose.

- ASME engine fuel tanks are always refilled on the vehicle. These containers are manufactured under the provisions of the ASME Pressure Vessel Code. Periodic requalification is not required, but the tanks should be inspected for unusual wear or physical damage, and the paint must be kept in good condition.

## Research on Conversion Vehicles

DOE's National Renewable Energy Laboratory (NREL) has sponsored and published studies of conversion vehicles:

- "Natural Gas Vehicle Conversion System Testing," conducted by the Institute of Gas Technology, examines four state-of-the-art, electronic, closed-loop natural gas vehicle conversion systems.
- "Evaluation of Aftermarket LPG Conversion Kits in Light-Duty Vehicle Applications," conducted by Southwest Research Institute, examines three propane conversion kits.

- "Evaluation of Aftermarket Fuel Delivery Systems for Natural Gas and LPG Vehicles," by Colorado State University, reviews other documents that examined conversion kits.
- "Compressed Natural Gas and Liquefied Petroleum Gas Conversion: The National Renewable Energy Laboratory's Experience" documents NREL's study of CNG and LPG conversion vehicles in the federal fleet.

## Notes:

<sup>1</sup> The Energy Information Administration assesses that its vehicle estimates might be understated by as much as 50%. (See *Alternatives to Traditional Transportation Fuels: An Overview*, DOE/EIA-0585/O, U.S. Department of Energy, Energy Information Administration.)

<sup>2</sup> As defined in EPACT, "alternative fuels" include methanol, denatured ethanol, and other alcohols, separate or in mixtures of 85 vol% or more (but not less than 70 vol%, by rule, to allow for cold start, safety, or other functions) with gasoline or other fuels; compressed natural gas; liquefied petroleum gas (propane); hydrogen; "coal-derived liquid fuels"; fuels derived from "biological materials"; electricity; or any other fuel "substantially not petroleum" yielding "substantial energy security benefits and substantial environmental benefits."

<sup>3</sup> According to CAA, "clean alternative fuels" include methanol (M85), ethanol (E85), other alcohols, reformulated gasoline, diesel, natural gas, liquefied petroleum gas (propane), electricity, or "any other power source" able to meet federal Clean Fuel Vehicle emissions standards.

<sup>4</sup> Propane is often referred to as liquefied petroleum gas (LPG), a liquid mixture of at least 90% propane, 2.5% butane and higher hydrocarbons, and the balance ethane and propylene.

<sup>5</sup> CAA and EPACT use the term "dual-fuel" to refer to bi-fuel vehicles.

## INFORMATION SOURCES FOR VEHICLE CONVERSIONS

| <i>Topic</i>  | <i>Source</i>  |
|---|--|
| General information on alternative fuels (research, studies, refueling site maps, references) | Alternative Fuels Data Center<br>National Alternative Fuels<br>Hotline 800-423-1363<br><a href="http://www.afdc.doe.gov">http://www.afdc.doe.gov</a>   |
| ANSI standards and certification  | American National Standards Institute<br>11 W. 42nd St., New York, NY 10036<br>212-642-4900<br><a href="http://www.ansi.org">http://www.ansi.org</a>   |
| ASE technician certification  | National Institute for Automotive<br>Service Excellence<br>13505 Dulles Technology Drive<br>Herndon, VA 22071<br>703-713-3800  |
| ASME codes  | American Society of Mechanical Engineers<br>345 E. 47th St., New York, NY<br>10017-2392 212-705-8500<br><a href="http://www.asme.org">http://www.asme.org</a>  |
| California-approved conversion kits and aftermarket parts                                     | California Air Resources Board<br>Office of Communications<br>2020 L St., Sacramento, CA 95812<br>916-322-2990<br><a href="http://www.arb.ca.gov">http://www.arb.ca.gov</a>  |
| Colorado-approved conversion kits for high altitudes  | Colorado Department of Public<br>Health & Environment<br>4300 Cherry Creek Dr., S.,<br>Denver, CO 80222-1530<br>303-962-3125/303-692-3135<br><a href="http://state.co.us/gov_dir/cdphe_dir/cdphehom.html">http://state.co.us/gov_dir/cdphe_dir/cdphehom.html</a> |

## INFORMATION SOURCES FOR VEHICLE CONVERSIONS

| <i>Topic</i>                           | <i>Source</i>  |
|--|--|
| EPA-approved testing laboratories      | U.S. Environmental Protection Agency<br>National Vehicle & Fuel Emissions<br>Laboratory<br>2656 Plymouth Road,<br>Ann Arbor, MI 48105<br>313-668-4216<br><a href="http://www.epa.gov/docs/omswww/01-nvfel.htm">http://www.epa.gov/docs/omswww/01-nvfel.htm</a> |
| Federal tampering laws                 | U.S. Environmental Protection Agency<br>Office of Mobile Sources<br>401 M St., S.W., Washington, DC 20460<br>202-260-7645<br><a href="http://www.epa.gov/omswww">http://www.epa.gov/omswww</a>   |
| Natural gas vehicle industry standards | Natural Gas Vehicle Coalition<br>1515 Wilson Blvd., Suite 1030<br>Arlington, VA 22209<br>703-527-3022  |
| NFPA standards                         | National Fire Protection Association<br>1 Batterymarch Park, P.O. Box 9101<br>Quincy, MA 02269-9101<br>617-770-3000<br><a href="http://www.wpi.edu/~fpe/nfpa.html">http://www.wpi.edu/~fpe/nfpa.html</a>   |
| NTHSA safety regulations               | U.S. Department of Transportation<br>National Highway Traffic Safety<br>Administration<br>400 Seventh St., S.W.,<br>Washington, D.C. 20590<br>202-366-4931<br><a href="http://www.nhtsa.gov">http://www.nhtsa.gov</a><br>Auto Safety Hotline: 800-424-9393     |

## APPENDIX

### *Fact Sheet on Conversions and Emission Reductions*

Until now, converting a vehicle to an alternative fuel carried no responsibility for ensuring that the design, installation, and operation of the vehicle would result in lower emissions than those of the original vehicle. Because the complete vehicle was not emission tested and no entity was responsible for the emissions, it has not been possible for states or the nation to claim emission benefits from AFVs. New EPA regulations will help resolve this situation; vehicles may be converted in three ways:

- a. To market converted vehicles that can be considered clean fuel vehicles (CFVs) and be eligible for the Clean Fuel Fleet program, the converter can take on the responsibilities of a vehicle manufacturer, including
  - Establishing a specific combination of conversion technology and an existing vehicle type (“engine family”),
  - Performing full emission testing (in-house or contract testing under the Federal Test Procedure to show compliance with CFV emission standards and durability requirements,
  - Applying for a “certificate of conformity” from the EPA, and
  - On receipt of a certificate, producing all vehicles exactly like the test vehicle and accepting liability for the vehicle emissions.

Before being sold, each vehicle converted to a CFV must also receive a simple idle test, either at a local inspection and maintenance facility or at the converter’s facility. This test detects extreme cases of poor installation.

- b. Certified CFV conversions, like all CFVs, are eligible for purchase credits under the fleet program. EPA also recognizes the emission reductions of these vehicles in State Implementation Plans (SIPs) and state marketable emission reduction credit (MERC) programs.

Converted vehicles may also be certified to non-CFV emission levels (e.g., Tier 1 or TLEV standards). The converter goes through the same certification process as for CFVs and thus becomes exempt from liability under the CAA tampering provisions. When the certified emission levels are lower than those of other vehicles, the EPA recognizes the emission reductions of vehicles certified in this way in SIPs and state MERC programs.

- c. Entities that convert vehicles without going through the certification process have no special protection against tampering and are covered under the Memo 1A tampering policy. The emissions of such vehicles are unknown and may not be cleaner than those of the base vehicle; therefore, the EPA and states cannot recognize emission reductions from these vehicles.

Tad Wysor, EPA Office of Mobile Sources, 7/94

## NOTES

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